Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1-41. (Canceled)

42. (New) A method of analysis of an object, comprising:

generating non-planar penetrating radiation;

diffracting the radiation from a monochromator to provide a beam of monochromatic penetrating radiation;

irradiating a portion of the object with the beam of monochromatic penetrating radiation;

diffracting, from an analyzer onto a detector, penetrating radiation that passes through the object onto the analyzer;

rotating the analyzer through a plurality of angular positions; and

measuring a plurality of intensities of the radiation incident on the detector as a function of analyzer position.

43. (New) The method of claim 42, comprising determining, from the measured intensities, a complex scattering function of the portion of the object.

44. (New) The method of claim 42, comprising passing the beam of radiation in a direction of propagation through a slit prior to incidence of the beam on the portion of the object, wherein the slit has a size A in a direction transverse to the direction of propagation of the beam and calculated according to the formula:

$$A \leq \lambda/\delta\theta$$

wherein λ is the wavelength of incident radiation and $\delta\theta$ is optical resolution provided by the monochromator and the analyzer.

45. (New) The method of claim 42 wherein the analyzer is rotated in incremental steps α, wherein $\alpha \leq \delta\theta/2$ and $\delta\theta$ is optical resolution provided by the monochromator and the analyzer.

46. (New) The method of claim 42 wherein the detector comprises a PIN diode detector.

47. (New) The method of claim 42 wherein the step of generating comprises producing radiation from a characteristic line source.

48. (New) The method of claim 47 wherein the characteristic line source is a rotating anode source.

49. (New) The method of claim 42, comprising:

calculating a complex scattering amplitude of the irradiated portion of the object from the measured intensities; and

determining from said complex scattering amplitude an inverse Fourier Transform to obtain a complex scattering function.

50. (New) The method of claim 49, comprising:

normalizing the measured intensities;

calculating a modulus of the complex scattering amplitude from the normalized intensities;

calculating, from said modulus, phase information for the complex scattering amplitude; and

determining, from said modulus and phase information, the complex scattering amplitude.

51. (New) The method of claim 42, comprising:

determining, from the measured intensities, a complex scattering function of the portion of the object; and

determining, from the complex scattering function, a complex refractive index profile of the irradiated portion of the object.

52. (New) An apparatus for analyzing an object, comprising:

a source of non-planar penetrating radiation;

a monochromator for diffracting the non-planar penetrating radiation to provide a beam of monochromatic penetrating radiation, said beam having a direction of propagation;

a detector for detecting the monochromatic penetrating radiation that passes through an object;

an analyzer for diffracting the monochromatic penetrating radiation that passes through the object onto the detector;

means for rotating the analyzer between a plurality of angular positions; and

means for recording one or a plurality of intensities of radiation incident on the detector as a function of analyzer position.

53. (New) The apparatus of claim 52 comprising means for determining, from the recorded intensities, a complex scattering function of the object.

54. (New) The apparatus of claim 52 comprising a slit through which the beam of monochromatic penetrating radiation passes prior to incidence of the beam on the object, wherein the slit has a size A in a direction transverse to the direction of propagation of the beam and calculated according to the formula:

$$A \leq \lambda/\delta\theta$$

wherein λ is the wavelength of incident radiation and $\delta\theta$ is optical resolution provided by the apparatus.

55. (New) The apparatus of claim 52 wherein the analyzer is rotated in incremental steps α, wherein $\alpha \leq \delta\theta/2$ and $\delta\theta$ is optical resolution provided by the apparatus.

56. (New) The apparatus of claim 52 wherein the detector comprises a PIN diode detector.

57. (New) The apparatus of claim 52 wherein the source of non-planar penetrating radiation comprises a characteristic line source.

58. (New) The apparatus of claim 52 wherein the source of non-planar penetrating radiation comprises a rotating anode source.

59. (New) The apparatus of claim 52 comprising means for determining, from the measured intensities, a complex scattering function of the object, wherein said means for determining a complex scattering function comprises (i) means for calculating, from the recorded intensities, a complex scattering amplitude of an irradiated portion of the object; and (ii) means for determining from said complex scattering amplitude an inverse Fourier Transform to obtain a complex scattering function.

60. (New) The apparatus of claim 59, comprising:

means for normalizing the measured intensities;

means for calculating a modulus of the complex scattering amplitude form the normalized intensities;

means for calculating, from said modulus, phase information for the complex scattering amplitude; and

means for determining, from said modulus and phase information, the complex scattering amplitude.

61. (New) A method of analysis of an object, comprising:

generating penetrating radiation;

diffracting the radiation from a monochromator to provide a beam of monochromatic penetrating radiation;

passing the beam of radiation in a direction of propagation through a slit, wherein the slit has a size A in a direction transverse to the direction of propagation of the beam and calculated according to the formula:

$A \leq \lambda/\delta\theta$

wherein λ is the wavelength of incident radiation and $\delta\theta$ is optical resolution provided by the monochromator and an analyzer;

irradiating a portion of the object with the beam;

diffracting, from the analyzer onto a detector, radiation that passes through the object onto the analyzer;

rotating the analyzer through a plurality of angular positions; and

measuring a plurality of intensities of the radiation incident on the detector as a function of analyzer position.

62. (New) The method of claim 61 comprising determining, from the measured intensities, a complex scattering function of the portion of the object.

63. (New) The method of claim 61 wherein the penetrating radiation is non-planar penetrating radiation.

64. (New) The method of claim 61 wherein the analyzer is rotated in incremental steps α, wherein $\alpha \leq \delta\theta/2$ and $\delta\theta$ is optical resolution provided by the monochromator and the analyzer.

65. (New) The method of claim 61 wherein the detector comprises a PIN diode detector.

66. (New) The method of claim 61 wherein the step of generating comprises producing radiation from a characteristic line source.

67. (New) The method of claim 66 wherein the characteristic line source is a rotating anode source.

68. (New) The method of claim 61, comprising:

calculating a complex scattering amplitude of the irradiated portion of the object from the measured intensities; and

determining from said complex scattering amplitude an inverse Fourier Transform to obtain a complex scattering function.

69. (New) The method of claim 68, comprising:

normalizing the measured intensities;

calculating a modulus of the complex scattering amplitude from the normalized intensities;

calculating, from said modulus, phase information for the complex scattering amplitude; and

determining, from said modulus and phase information, the complex scattering amplitude.

70. (New) The method of claim 61, comprising:

determining, from the measured intensities, a complex scattering function of the portion of the object; and

determining, from the complex scattering function, a complex refractive index profile of the irradiated portion of the object.

71. (New) An apparatus for analyzing an object, comprising:

a source of penetrating radiation;

a monchromator for diffracting the penetrating radiation to provide a beam of monochromatic penetrating radiation, said beam having a direction of propagation;

a slit member defining a slit through which the beam passes prior to incidence of the beam on the object, wherein the slit has a size A in a direction transverse to the direction of propagation of the beam and calculated according to the formula:

$$A \leq \lambda/\delta\theta$$

wherein λ is the wavelength of incident radiation and $\delta\theta$ is optical resolution of the apparatus;

a detector for detecting radiation that passes through the object;

an analyzer for diffracting the radiation that passes through the object onto the detector;

means for rotating the analyzer between a plurality of angular positions; and

means for recording one or a plurality of intensities of radiation incident on the detector as a function of analyzer position.

72. (New) The apparatus of claim 71, comprising means for determining, from the recorded intensities, a complex scattering function of a portion of the object.

73. (New) The apparatus of claim 71 wherein the analyzer is rotated in incremental steps α, wherein $\alpha \leq \delta\theta/2$ and $\delta\theta$ is optical resolution provided by the apparatus.

74. (New) The apparatus of claim 71 wherein the detector comprises a PIN diode detector.

75. (New) The apparatus of claim 71 wherein the source of radiation is a characteristic line source.

76. (New) The apparatus of claim 71 wherein the source of radiation is a rotating anode source.

77. (New) The apparatus of claim 71 comprising means for determining, from the measured intensities, a complex scattering function of the object, wherein said means for determining a complex scattering function comprises (i) means for calculating, from the recorded intensities, a complex scattering amplitude of an irradiated portion of the object; and (ii) means for determining from said complex scattering amplitude an inverse Fourier Transform to obtain a complex scattering function.

78. (New) The apparatus of claim 77, comprising:

means for normalizing the measured intensities;

means for calculating a modulus of the complex scattering amplitude form the normalized intensities;

means for calculating, from said modulus, phase information for the complex scattering amplitude; and

means for determining, from said modulus and phase information, the complex scattering amplitude.

79. (New) A method of analyzing an object, comprising:

irradiating a portion of the object with a beam of monochromatic x-rays;

detecting an intensity profile of an angular spectrum of x-rays emerging from the irradiated portion; and

determining a complex scattering function for the irradiated portion of the object.

80. (New) A method of analyzing an object, comprising:

irradiating a portion of the object with a beam of monochromatic x-ray radiation;

diffracting, with an analyzer means, x-rays emerging from the portion of the object into an x-ray detector; and

obtaining an angular spectrum of non-Bragg diffracted x-ray intensities as a function of angular position of the analyzer means.

81. (New) A method of analyzing an object, comprising:

collecting generic x-ray diffraction data from a portion of the object that is irradiated with a beam having a direction of propagation; and

analyzing said data to obtain a complex refractive index of the portion in a direction that is transverse to the direction of propagation of the beam.